THE SMITH 0.01-ML SYRINGE IN THE MICROSCOPIC GRADING OF MILK

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The 0.01 ml Smith syringe was developed to overcome the serious errors in measurement which occur when a 0.01 ml glass pipette is used in high-speed, large-volume microscopic grading of milk. This syringe has been used exclusively by the California Department of Agriculture since January, 1949, and has brought about a revolutionary improvement in accuracy. Measurement of the 0.01 ml volume is automatically accurate.

A recent contribution of importance to the Breed method has been the development of a new mechanical device for measuring the 0.01 ml volume of milk. In view of the possibility that it may be recognized in the forthcoming edition of Standard Methods for the Examination of Dairy Products, a description of its nature and operation may be of considerable interest.

The Breed direct microscopic count method, has been used since 1924 in California and has been an indispensable means for the rapid field grading of milk used for manufacturing purposes. Adoption of the Breed method was followed, in 1926, by the introduction of a combined defatting-fixing-staining solution which considerably increased the speed and efficiency of platform grading. Our second improvement in terms of speed and accuracy has been the adoption of the Smith syringe for measuring the 0.01 ml portion of milk.

In 1945, while the writer was making a survey of the microscopic count technique used by our field inspectors one of them, Mr. Ralph Smith, showed me his first crude model of what he called a mechanical pipette. The fundamental advantages and possibilities of this device were so apparent that every encouragement was given Mr. Smith to develop the idea into a practical working model. Lacking necessary lathes and tools, he enlisted the aid of a local jeweler, Mr. George S. Riggs. He turned over the patent rights to Mr. Riggs who finally perfected the device and placed it on the market about two years ago.

In the accompanying photographs, Plate I shows the exterior appearance of the syringe assembled ready for use, while Plate II shows the syringe taken apart to indicate details of its working parts.

Basically, the device operates on the principle of the hypodermic syringe except that the conventional plunger has been replaced with a wire about 0.5 mm in diameter. Pressure on this wire plunger forces it down to the tip through which it protrudes slightly to facilitate spreading of the milk over the 1-sq. cm. area. After spreading is completed, the plunger is released and a spiral spring causes the wire to return instantly to its original position.

Prior to each sample, the syringe is rinsed in clean, cold water containing an approved quaternary ammonium compound (2 drops to 6 ounces of tap water). The quaternary ammonium compound is used to prevent growth of bacteria with danger of subsequent contamination from this source during hot weather. Rising is accomplished by drawing in and expelling the water three times. This is followed by a similar rinse in the sample of milk or cream to be examined.

Then, with the tip of the syringe beneath the surface of the milk (or cream), the plunger is released. After wiping the excess milk or cream from the tip with a clean, dry flannel cloth, the 0.01 ml charge is expelled in the center of the 1-sq. cm area. The syringe is held vertically during expulsion and spreading of the milk.

Spreading is done with the tip of the syringe, beginning at the periphery of the round 1-sq. cm area.

Mr. Newman graduated from George Washington University with B.S. in bacteriology. He served 19 months in World War I. U.S. Department of Agriculture, U.S. Hygienic Laboratory (U.S.P.H.S.) both in Washington. He returned to California in 1921 as Dairy Bacteriologist, Bureau of Dairy Service Laboratory, California Department of Agriculture. He has studied particularly the simplification of staining and other procedures of Breed direct count method, first routine procedure for the bacteriological examination of frozen desserts and ingredients, procedures for isolating and identifying food poisoning and other organisms in dairy products, etc.

and working in toward the center, using care to spread the milk or cream evenly. In order to prevent any milk being withdrawn into the syringe from the film, the plunger must not be released until the tip of the syringe has been removed from the film. Rising with water and milk are repeated between each successive sample of milk or cream.

At the end of each day's work, the syringe immediately is taken apart and the wire plunger and the inside of the barrel are wiped dry with clean, dry flannel, care being taken not to loosen the locknut screw on the plunger assembly.

These syringes are easily calibrated by expelling and spreading milk (at 20° C) onto a glass slide. The slide is counterbalanced on the pan of a chainomatic balance and then counterbalanced again with the exact weight of 0.01 ml of milk.
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PLATE I. Smith 0.01 ml. syringe ready for use together with round area slide for milk films.

(0.0103 gm) before the milk is added to the slide.

After drawing up the charge, the syringe tip is wiped free of adhering milk, then held vertically on the slide while expelling the milk, using a rotary motion beginning at the periphery and ending at the center of the round 1-sq cm area. The syringe is held vertically until spreading is completed and plunger is not released until after the syringe is raised from the milk film. Spreading and re-weighing must be done very rapidly in order to prevent evaporation of milk. The syringes are adjusted until four to six consecutive weighings agree at 0.010 gm (as close to 0.0103 gm as possible). As these syringes are used in the same manner in field work (vertical expulsion, spreading, release of plunger after removal from milk film), any error resulting from milk adhering to the tip upon removal from the film should be reduced to a minimum.

Adjustments are made by tightening or loosening locknut "A" until the syringe consistently delivers exactly 0.010 gm of milk. The nut then is locked at that position by means of a small set screw. Thereafter, except when necessary to readjust the plunger stroke in order to assure 0.01-ml deliveries, this locknut screw must not be loosened.

It might be considered desirable to check the calibration of these syringes at twelve-month intervals in order to correct any errors possibly due to wear or other causes. It will be noted that reference has been made to the use of round 1-sq cm areas. Conventional 1"x3" glass slides has been sandblasted to provide five circular areas (diameter 1.1285 cm) together with marginal space for identification purposes (Plate I). This type of slide was developed by us* in order to facilitate rotary spreading. When one is working at high speed, the natural tendency is to use a quick rotary motion which is not feasible with square areas. With the latter, the square has to be carefully, painstakingly outlined and then the center portion filled in. The tendency is to skip the corners of the area and all too often, in outlining the square, the line may waver and the result may be an approximation rather than a true square. On the contrary, when using the natural rotary spreading there are no troublesome corners to contend with and the saving in time and nervous tension may be devoted to greater care in making the films. An additional saving in time occurs when the tip of the syringe is used for spreading.

PLATE II. Smith 0.01 ml. syringe disassembled to show details of working part.

PRACTICAL VALUE

While these factors are of little importance to those working in a laboratory and under laboratory conditions where the time element is not a pressing problem, they are of major importance in high-speed field grading where often there is no time even to drop the syringe or pipette and take up a spreading needle.

Twenty-seven inspectors of this department devote their full time to the field grading of manufacturing milk. All of them have used these syringes exclusively since January, 1949, when, after some 25 years, the use of glass pipettes finally was discontinued. After using

*The technique of sand-blasting these round area slides was devised in this laboratory by Mr. Loyd Stout, Laboratory Technician.
THE BACTERIAL COUNTS ON PASTEURIZED MILK HELD IN REFRIGERATED STORAGE

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The Department of Farms and Markets has the responsibility of the quality of milk sold in Connecticut. The Bureau of Laboratories of the State Department of Health is the official laboratory used by the Department of Farms and Markets for official analysis of samples of milk and dairy products.

In order to obtain information as to what happens to pasteurized milk in refrigerated storage, the following procedure was used on samples submitted to the Bureau of Laboratories by the Department of Farms and Markets from Dealers A and B. Six quarts of freshly pasteurized milk, that were consecutive bottles from the filler near the middle of the run of the grade of milk being processed, were well iced, and delivered to the laboratory within ½ hour for analysis.

Bottle No. 1 was tested for bacteria and put in refrigerated storage. Bottle No. 2 was also tested for bacteria to provide a check on the duplication, and was then tested for fat, solids, flavor and odor, and discarded. Bottles Nos. 3, 4, 5, and 6 were placed in refrigerated storage until used. The next day, Bottle No. 1 was again tested for bacteria. Bottle No. 3 was tested for bacteria, fat, solids, flavor, and odor, and then discarded.

The following day, Bottle No. 1 was again tested for bacteria, and the same procedure used on Bottle No. 4 as had been used on No. 3. The next day, Bottles Nos. 1 and 5 were tested, and Nos. 1 and 6 on the next day. The purpose in running the bacteria counts for six days on the same sample was to see if the repeated agitation had any apparent effect on the bacteria count.

The above procedure was also used by laboratories C, D, and E in their own approved laboratory, such laboratories operating under the approval of the Bureau of Laboratories of the State Department of Health.

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